FLIGHT BEHAVIOR OF THE PREDACEOUS DIVING BEETLE, *CYBISTER FIMBRIOLATUS FIMBRIOLATUS* (SAY) (COLEOPTERA: DYTISCIDAE)

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ABSTRACT

Flight behavior of *Cybister f. fimbriolatus* (Say) is described for specimens from Florida. It is suggested that such flights are prerequisite for mating and this is an adaptive mechanism for extending the range of the species.

Many insects, as well as other animals, inhabit both an aquatic and a terrestrial environment during their life cycles. Frequently, insect metamorphosis is directly associated with emergence from an aquatic to a terrestrial environment. Members of the beetle family Dytiscidae, commonly called predaceous diving beetles, incur a similar kind of environmental change during their life cycle. The larvae, commonly known as watertigers, are restricted to the aquatic medium, however, at some advanced point they leave the water to pupate in moist earth at the water's edge. Following metamorphosis, the emerging adults, like the larvae, again inhabit the water. However, the adults of many species, unlike their larvae, also frequent the terrestrial environment as well and are capable of both graceful swimming in water and sustained flying in air. In fact, it is not uncommon to find Dytiscidae in flight some distance from water bodies.

Dytiscid flight and dispersion capabilities over short distances have been well documented by several authors, most notably Wilson (1923). However, the factors which initiate flight remain to be fully ascertained. The notion that flight occurs due to scarcity of food recurs in the literature for Dytiscidate as it does for many other insects. Contrary to this belief, my observations from both laboratory and field work indicate that the flight behavior of *Cybister fimbriolatus fimbriolatus* (Say), one of the larger species, is directly associated with mating and may be a necessary prerequisite, as well as an adaptive advantage.

During the past 3 years our laboratory has embarked on an intensive program of study investigating the feeding behavior (Johnson and Jakinovich 1970) and receptor characteristics of the sense organs borne by *C. f. fimbriolatus* (Yasazumi, Yamaguchi, and Johnson 1971). For these purposes large quantities of these beetles have been collected in the field and maintained in laboratories at the University of Michigan. The principal geographic source for these beetles has been the counties of Marion and Citrus in Florida. This semitropical region is rich in clear water springs, shallow fresh water ponds, unique river systems, and abundant cypress swamps.

Beetles were collected by various means. Some were obtained by sweeping ponds and swamps with a hand scoop net; others by using floating minnow traps left overnight with beef liver or pieces of raw fish (bluegill) as bait. In addition to these methods, many were collected at night near the street lights in Dunnellon, Florida some distance from any natural water body. During night flight, these beetles exhibit the common insect behavioral characteristic of congregating at lights. In fact, about 1 to 3 times a year congregation at lights is of such proportions in and near Dunnellon that many residents consider this beetle to be a nuisance. Collection at lights has been by far the most fruitful method of obtaining beetles, but also the most restrictive. The opportunities to collect them by this means are few.

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Swarming at lights occurs only a few times a year, usually during late spring or early summer. This is the same period which many authors report as the mating period for Dytiscidae. During the spring of the years 1969-70, each catch of beetles collected at lights and transferred to laboratory aquaria had a very high frequency of copulatory activity which gradually decreased in intensity over a period of about 3 weeks unti it ceased entirely. In fact, this high frequency of copulation was maintained in spite of unusual stress to the beetles; packing them in boxes, shipment by air from Florida to Michigan, and then transfer to aquaria. Even in these instances, beetles typically began to copulate within an hour after transfer. Copulation in laboratory aquaria has never been observed for beetles collected with nets or traps from the same area. In fact, beetles have been collected from waters within a week or 2 preceding observed flight and swarming, but these were never observed to mate. Thus, although the exact sequence of events between flight and subsequent mating remain yet to be determined, it seems definite that the 2 activities are in some way linked and that flight may be a necessary part of the life cycle of *C. f. fimbriolatus* and possibly a direct prerequisite for mating. In fact, it seems quite probable that such flight and associated mating behavior is an adaptive mechanism for expanding existing habitat (i.e. a dispersive mechanism).

Several dytiscid species, as well as other aquatic beetles, are quite common to this region of Florida, but other species have not been observed to fly in such numbers at the same times as *C. f. fimbriolatus*. Thus, it appears that species specific genetic factors, and probably environmental conditions as well, are involved in the initiation of flight and subsequent mating. Environmental variables have not been monitored in the region, but the few nights of the year that flights occur does indicate that such factors as photoperiod, temperature, and barometric pressure may play some role.

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